IN THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application. An identifier indicating the status of each claim is provided.

Listing of Claims

1. (Previously Presented) A movement control system for a robot having a base and a plurality of movable regions connected to the base, the system comprising:

fundamental constraint-condition setters for setting movement constraint-conditions, which are imposed in accordance with a task and a movement state applied to the robot, for each kind of constraint;

a constraint-condition setting unit for imposing the movement constraint conditions of the entire robot necessary for a state variation of the robot by selectively using the appropriate fundamental constraint-condition setter in accordance with a movement-constraint requirement produced during execution of a task and a movement of the robot; and

a drive-amount determining unit for determining a drive amount of each of the movable regions so as to satisfy the entire movement-constraint conditions set by the constraint-condition setting unit,

wherein movement constraint-conditions comprises conditions corresponding to constraints regarding to an original point position of a link, a link posture, a gravity center position of a link, a joint angle, a gravity center position of the robot, or an entire angular momentum.

2. (Original) A system according to claim 1, wherein the plurality of movable regions comprise at least an upper limb, a lower limb, and a body section.

3. (Original) A system according to claim 1, wherein a posture angle of the entire robot is expressed using a virtual joint angle of a virtual link.

4. (Original) A system according to claim 1, wherein each of the fundamental constraint-condition setters for each kind of constraint expresses movement constraint conditions imposed in accordance with a task and a movement state of the robot as a linear equality of a variation of a state variable.

5. (Original) A system according to claim 4, wherein each of the fundamental constraint-condition setters expresses a constraint equation by a Jacobian form.

6. (Original) A system according to claim 1, wherein each of the fundamental constraint-condition setters expresses a movement constraint condition imposed in accordance with a task and a movement state of the robot as a linear inequality equation of a variation of a state variable.

7. (Previously Presented) A movement control system for a robot having a base and a plurality of movable regions connected to the base, the system comprising:

fundamental redundancy drive-method setters for setting redundancy drive-methods, which are changed in accordance with a task and a movement state applied to the robot, for each kind of norm;

a redundancy drive-method setting unit for setting redundancy drive-methods of the entire robot by selectively using the appropriate fundamental redundancy drive-method setter in accordance with a requirement for changes generated during execution of a task and a movement of the robot; and

a drive-amount determining unit for determining a drive amount of each of the movable regions so as to satisfy the redundancy drive-method set by the redundancy drive-method setting unit,

wherein the redundancy drive-method is set to minimize system state changes and target state deviation.

8. (Previously Presented) A movement control system for a robot having a base and a plurality of movable regions connected to the base, the system comprising:

equality-constraint condition setters for expressing movement constraint-conditions, which are imposed in accordance with a task and a movement state applied to the robot, for each kind of constraint by a linear equality equation of a variation of a state variable;

an equality-constraint condition setting unit for imposing movement-constraint conditions of the entire robot necessary for a state variation of the robot by selectively using the appropriate equality-constraint condition setter in accordance with a requirement for a movement constraint generated during execution of a task and a movement of the robot;

inequality-constraint condition setters for expressing movement constraint-conditions, which are imposed in accordance with a task and a movement state applied to the robot, for each kind of constraint by a linear inequality equation of a variation of a state variable;

an inequality-constraint condition setting unit for imposing movement-constraint conditions of the entire robot necessary for a state variation of the robot by selectively using the appropriate inequality-constraint condition setter in accordance with a requirement for a movement constraint generated during execution of a task and a movement of the robot;

fundamental redundancy drive-method setters for setting redundancy drive-methods, which are changed in accordance with a task and a movement state applied to the robot, for each kind of norm;

a redundancy drive-method setting unit for setting redundancy drive-methods of the entire robot by selectively using the appropriate fundamental redundancy drive-method setter in accordance with a requirement for changes generated during execution of a task and a movement of the robot; and

a drive-amount determining unit for determining a drive amount of each of the movable regions so as to entirely satisfy equality and inequality-constraint conditions of the entire robot set by the equality-constraint condition setting unit and the inequality-constraint condition setting unit, and to entirely satisfy redundancy drive-methods of the entire robot set by the redundancy drive-method setting unit,

wherein movement constraint-conditions comprises conditions correspond to constraints regarding to an original point position of a link, a link posture, a gravity center position of a link, a joint angle, a gravity center position of the entire robot, or an entire angular momentum, and

wherein the redundancy drive-method is set to minimize system state changes and target state deviation.

9. (Original) A system according to claim 8, wherein the plurality of movable regions comprise at least an upper limb, a lower limb, and a body section.

10. (Original) A system according to claim 8, wherein a posture angle of the legged walking robot is expressed using a virtual joint angle of a virtual link.

11. (Original) A system according to claim 8, wherein each of the equality-constraint condition setters expresses a constraint equation by a Jacobian form.

12. (Original) A system according to claim 8, wherein the drive-amount determining unit comprises: a quadratic programming-problem solver for solving a variation of a state variable of the robot by formulating equality and inequality-constraint conditions of the entire robot and redundancy drive-methods of the entire robot as quadratic programming-problems; and an integrator for calculating a state of the robot at a succeeding time by integrating a variation of a state variable.